CHEMICAL LIBRARY

MAR 3 1931

AMERICAN JOURNAL of PHARMACY

SINCE 1825

A Record of the Progress of Pharmacy and the Allied Sciences

COMMITTEE ON PUBLICATION

Charles H. LaWall, Ph. M., Sc. D. Joseph W. England, Ph. M. J. W. Sturmer, Pharm. D.
John K. Thum, Ph. M. Arno Viehoever, Ph. D. E. Fullerton Cook, Ph. M.

IVOR GRIFFITH, Ph. M., Editor

Vol. 103 FEBRUARY, 1931 No. 2

CONTENTS

Editorial:
History Repeats Itself: Corn Syrup 1907—Corn Sugar 1930 57

Selected Editorial:
Centenary of Professor Maisch. (Reprinted From the *Evening Bulletin*) .. 60

Original Articles:
Under Invisible Light. By J. W. Sturmer, Philadelphia, Pa. 62
Cascara (Illustrated)). *To be Continued.* By T. J. Starker, Oregon State College, and A. R. Wilcox, U. S. F. S., Oregon 73

In Memoriam:
William Duffield Robinson, M. D., 1856-1931 98

Reprinted Article:
The Micro-Detection of Alkaloids. (Reprinted From *The Analyst*) 100

Medical and Pharmaceutical Notes 104

Price $3.00 per Annum in Advance **Foreign Postage, 25 Cents Extra**

Single Numbers, 30 Cents. Back Numbers, 50 Cents

Entered as Second-Class Matter at the Post Office at Philadelphia, Pa., Under the Act of March 3, 1879

Acceptance for Mailing at Special Rate of Postage Provided for in Section 1103, Act of October 3, 1917. Authorized February 15, 1920

PUBLISHED MONTHLY BY THE

Philadelphia College of Pharmacy and Science

43d Street and Kingsessing Avenue, West Philadelphia, Pa.

For years it has been definitely accepted as good therapy to prescribe Syrup of Thiocol for respiratory affections, which means that Thiocol gives markedly good results. . . . . .

SYRUP of THIOCOL is a *one-drug* rational remedy aimed at the seat of the trouble—the infection itself. . . .

Devoid of narcotics
Never advertised to the laity

Marketed in 6-ounce prescription bottles and gallon bottles for pharmacies

Hoffmann-La Roche, Inc.
Makers of Medicines of Rare Quality
NUTLEY NEW JERSEY

THE AMERICAN
JOURNAL OF PHARMACY

VOL. 103 FEBRUARY, 1931 NO. 2

EDITORIAL

HISTORY REPEATS ITSELF

CORN SYRUP 1907—CORN SUGAR 1930

IN NOVEMBER, 1907, after an investigation of the subject lasting for a year or more, the United States Board of Food and Drug Inspection, composed of Dr. Harvey W. Wiley, Chief, Bureau of Chemistry; Dr. Frederick L. Dunlap, Associate Chemist, Bureau of Chemistry, and Mr. George P. McCabe, Solicitor of the Department of Agriculture, unanimously came to the conclusion that corn syrup was not a satisfactory synonym for glucose. The decision was communicated to the Corn Products Company by Dr. Harvey W. Wiley on November 8, 1907.

The Corn Products Company immediately protested the proposed decision and backed up their protest with a large number of opinions of eminent chemists to the effect that corn syrup was a proper designation for glucose made from corn. Dr. Wiley in turn obtained opinions from fifty-eight food commissioners and food chemists, out of which number fifty-five approved the proposed ruling that corn syrup was not a proper name for glucose.

The proposed ruling of the Board of Food and Drug Inspection was overruled or ignored and on February 13, 1908, there was issued the following ruling—signed by the Secretary of the Treasury, the Secretary of Agriculture and the Secretary of Commerce and Labor:

"We have each given careful consideration to the labeling under the pure food law, of the thick viscous sirup obtained by the incomplete hydrolysis of the starch of corn, and composed essentially of dextrose, maltose and dextrine.

"In our opinion it is lawful to label this sirup as 'Corn sirup,' and if to the corn sirup there is added a small percentage of refiners' sirup,

a product of the cane, the mixture in our judgment, is not misbranded if labeled 'Corn Sirup with Cane Flavor.'"

"Glucose" or "sirupy glucose," as it is sometimes called, is the product of a chemical reaction when starch is treated with acid, it is not a natural sirup. In other countries of the world it is made from potatoes, rice and other sources of starch which are cheap and for the most part is called "starch syrup," which is a more nearly correct name, although it may even be made from cellulose or wood fiber.

In America it happens to be made from corn because corn is the cheapest starchy grain but it does not bear the same relation to corn that cane syrup does to the cane, maple syrup does to the maple, nor sorghum syrup to the sorghum plant, for in fact and truth it is not the natural sugar of the corn (which gives to fresh corn on the cob its succulent sweetness) nor does it bear any relationship to it.

In December, 1925, there was introduced into both the House of Representatives and the Senate of the United States a bill providing for the amendment of the Food and Drugs Act so that the presence of dextrose (also called corn sugar) which is now available in a pure white crystalline form, would not require notification of its presence, as distinguished from sucrose (the product of either the cane or the beet) which has been the common sweetening agent used in prepared foods for centuries. The bill passed the Senate but was not passed by the House in its original form which was rejected by the Committee on Interstate and Foreign Commerce. The legislation failed of passage at this the Sixty-eighth Session of Congress.

The bill was reintroduced into the Sixty-ninth Session of Congress which opened in December, 1926, but again failed of passage, as have also similar and related measures up to the present time for not only have such disinterested organizations as the American Association of Dairy, Food and Drug Officials unanimously gone on record as opposing it, but such trade organizations as the National Canners Associations have been against it.

On July 25, 1930, Secretary Arthur M. Hyde, of the United States Department of Agriculture held a hearing at Washington, D. C., at which the same proponents and opponents appeared as had appeared at the congressional hearings several years ago, with the exception of the late Dr. Harvey W. Wiley who had been one of the first and most vigorous opponents of the legislation as an entering wedge in breaking down the efficiency of the Pure Food Law, which

was the principal reason for the opposition on the part of state officials and the officials of the Food and Drug Administration (formerly the well-known Bureau of Chemistry).

On December 26, 1930, Secretary Hyde issued the following ruling on the status of corn sugar under the Food and Drugs Act:

"Corn sugar (dextrose), when sold in packages, must be labeled as such; when sold in bulk must be declared as such; but the use of pure refined corn sugar as an ingredient in the packing, preparation or processing of any article of food in which sugar is a recognized element need not be declared upon the label of any such product. Nothing in this ruling shall be construed to permit the adulteration or imitation of any natural product, such as honey, by the addition of any sugar or other ingredient whatever."

Food officials everywhere regret that Secretary Hyde used his administrative power to give to the proponents of the undeclared use of corn sugar that which could not be obtained by legislative enactment.

CHARLES H. LAWALL.

SELECTED EDITORIAL

CENTENARY OF PROFESSOR JOHN M. MAISCH*

ONE of the greatest pharmacists and a man of world-wide repute as an educator and scientist, Professor John Michael Maisch, was born in Hanau, on the Main, in Germany, on January 30, 1831. He was long one of the master minds of Philadelphia's College of Pharmacy.

When he came to this country, in 1849, a penniless youth who had fled from a German prison camp where he had been locked up as a revolutionist and sentenced to be shot for his part in the Revolt of 1848, he landed in Baltimore where he secured a job in a box factory. Later he got a better job, in a mattress factory, but all the time the thoughts of this serious-minded youth were turned toward the study of plants and drugs. In his native land, under Theobald and Bromeis and other inspiring instructors, he had acquired a love of chemistry and botany and after working in various jobs in Baltimore, Washington and New York, he came to this city as the pharmaceutical center of America and secured a position as an assistant to Edward Parrish, who was then running a drug store on the northwest corner of Ninth and Chestnut Streets and conducting a school of practical pharmacy in the rear. Maisch was then twenty-five years of age.

After five years with Parrish he had become so well grounded in his profession that he was able to accept the chair of materia medica at the New York College of Pharmacy. Two years later, in 1863, he returned to Philadelphia to become head of the United States Army Laboratory, at Sixth and Oxford Streets, where during the next two years it is said he saved the government $750,000 in the manufacture of drugs for the use of the Union Army.

When the war was over he opened a small drug store, "an old fashioned apothecary's shop," at Sixteenth Street and Ridge Avenue, which he conducted for about five years, but which was long known thereafter as Maisch's pharmacy. During this time he became a member of the faculty of the Philadelphia College of Pharmacy, with wihch he was connected for twenty-seven years, during twenty-six

*Reprinted from "The Evening Bulletin," January 31, 1931.

of which he held the chair of materia medica and botany and during fourteen of which he was the dean.

The year 1871 saw him as editor of the *American Journal of Pharmacy,* a post which he held for twenty-two years until his death and where he won world renown as an observer and investigator. He was an industrious writer and, in addition to current comments on matters of his profession, found time to write four hundred original papers, several textbooks, and to assist in the preparation of the United States Pharmacopœia.

Many honors came to Maisch before he died, in the autumn of 1893, but the greatest was the award of the Hanbury Medal, given by England's scientists in memory of Daniel Hanbury, the eminent pharmacist. It was the first time this medal, awarded biennially "for original research in the natural history and chemistry of drugs," had been given to an American. The leading pharmacists of all lands were at the Chicago Exposition in the summer of that year when the prize was to be given to Maisch. But he was seriously ill at his home here so Professor Remnigton, who was afterwards head of the College of Pharmacy, was designated to accept it for him.

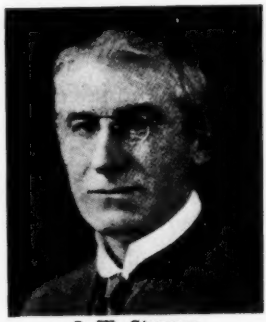
Remington did so and on his return to Philadelphia found the aged scholar dying. Standing beside the bed of the mortally stricken man, Remington handed him the medal. Maisch's face lighted up and showed his happiness at being thus rewarded but his head soon fell back on the pillow and a few days later he had passed on.

ORIGINAL ARTICLES

UNDER INVISIBLE LIGHT*

By Professor J. W. Sturmer

IT IS CUSTOMARY and natural to associate light with visibility, for our common ideas concerning light are purely subjective; they hinge upon our own sense-perception. Light, if we make this approach, is a manifestation of which we become cognizant through our optic organs, our eyes, an interpretation which leaves us completely in the dark regarding invisible light.



J. W. Sturmer

Indeed, this latter term which is not scientific but journalistic and popular, is absolutely meaningless if we do not for the moment forget our ideas concerning light as arrived at subjectively, and think of it objectively, as a form of radiant energy. If now we also accept that all forms of radiant energy are fundamentally alike, and that their dissimilarities are attributable to differences in vibration frequencies, or, as we might put it, in wave-lengths, we can draw upon our knowledge of radio to help us to a clearer understanding of the term invisible light. Suppose we think of our eyes as a kind of radio receiving set, one capable of "tuning in" all transmissions within a certain range. It is clear that any transmission outside of this range would not be receivable, notwithstanding the fact that it comes over the air in the same way, and is fundamentally identical with the transmissions which we can "tune in." Similarly, human eyes are responsive to certain light waves and not to others. The range, when it comes to reception, falls within a certain span of vibration frequencies, or, using the common expression, of wave-lengths.

RANGE OF INVISIBLE LIGHT

Now invisible light, or ultra-violet light, is radiant energy in wave-lengths which our eyes cannot tune in because the waves are too short and the frequencies too high. They range from the shortest waves which we can see, the

*One of a Series of Popular Science Lectures given at the Philadelphia College of Pharmacy and Science, 1930 Season. The demonstrations, unfortunately, cannot be here reproduced.

violet, downward to waves only one-fourth that long. The wave-lengths of invisible light, and the shorter ones, are so minute that our ordinary units of measure are impracticable, and special units had to be established. The unit most generally employed is named in honor of a Swedish scientist by the name of Ångström, and so it is called the Ångström unit, usually abbreviated Å. We shall use this unit.

LIGHT AND COLOR

In terms of Ångström units visible light—so-called—ranges in wave-lengths from about 3700 Å to about 7700 Å. When all these wave-lengths are represented, the light is without color, like daylight. White light may be separated into certain components which then exhibit color, the colors of the rainbow. But it should be understood that a rainbow color is not attributable to a single wave-length, but to a range of them. Thus violet light comprises the shortest visible range, from about 3700 Å to about 4300 Å; blue, from 4300 Å to 4900 Å; green, from 4900 Å to 5750 Å; yellow, from 5750 Å to 5850 Å; orange, from 5850 Å to 6500 Å, and red from 6500 Å to the end of the spectrum, which is about 7700 Å. We are careful to say "about" because there is no sharp line of demarcation, and the colors overlap and diffuse into each other. Moreover, the receiving mechanism, the human eye, varies, so that no two observers can agree where one color effect ends and another begins; nor can they agree on the exact limit of visibility.

But somewhere in the neighborhood of 7700 Å the visible rays melt into invisible heat rays, while wave-lengths shorter than approximately 3700 Å are also incapable of producing, in ordinary media, the phenomena of light. Thus light radiation represents a rather narrow span in terms of wave-lengths of radiant energy.

At this point someone may ask, "Do we actually see this radiation called visible light, or do we see its effect on matter? If we could be transported into empty interstellar space, could we really see a ray of what is called light?" In answer let us admit that the manifestations of light always involve material media. When light travels through empty space, as from the sun to the planet on which we live, it is merely a stream of energy—a stream of electrons, if we like—which leaves the empty space in darkness. But when it encounters the atmosphere which envelops the earth, it does something to the gases and vapors and solid particles in this atmosphere, and light-phenomena become manifest to the human eye. The clear sky be-

comes blue. Vapory clouds appear like balls of cotton, while the eastern sky at sunrise, and the western, at sun-set, may appear orange and red, with the fleecy clouds gorgeously embroidered with gold and tinted with rose and amethyst. Earth and rocks and vegetation respond with an exhibition of colors, colors which we know are associated with what is called light. Invisible light does not produce these effects.

SELECTIVE ABSORPTION OF LIGHT RAYS

We explain the tints observed in nature, the green of vegetation, the orange, yellow and red of autumnal foliage, the colors of flowers, on the theory of selective absorption, the colors which we see being depended upon the wave-lengths of light which are not absorbed, but are transmitted and reflected. Invisible light leaves our vegetation in total darkness.

Now what do we mean by absorption? What happens to the wave-lengths of light falling upon a green leaf and not appearing as a green color? We know that in this case some of the wave-lengths are expended in producing chemical changes within the leaf, changes which we speak of as photo-synthesis. Let us bear this fact in mind: radiant energy may do chemical work, and thus disappear. Next let us note what happens when some soot or lamp-black is placed on a cake of ice, and this is exposed to sunlight. We find that in the neighborhood of the black substance the ice melts much faster. Obviously, some of the light rays have been transformed into heat rays, which means that their frequencies have been stepped down, and their wave-lengths increased. Somehow the lamp-black has brought this about. The light rays apparently have set up a disturbance resulting in a vibration giving rise to the longer wave-lengths which are manifest as heat, but which are not associated with light-phenomena. The light has become invisible, become invisible because of a change in wave-lengths. It is common knowledge that much of the sunlight disappears in this manner—in rocks, in earth, and in vegetation.

ABSORPTION OF ULTRA-VIOLET

But sunlight comprises a great range of wave-lengths—light rays, heat rays, and the ultra-violet rays, which we know are invisible. When these latter are absorbed, do they also disappear, either by undergoing a change of wave-lengths, or by doing chemical work? Let us see.

Witness the life-guard on the beach at the seashore. When he enters upon his duties in early summer, his skin is light in color, like

yours and mine; but before many days a skin pigment called melanin, develops and that portion of his body which is not covered by his bathing suit, becomes tanned a deep brown, or, it may be, he develops freckles almost as dark, and almost as large, as gingersnaps. It is evident that the sunshine causes the pigmentation, and it is known that certain wave-lengths, falling within the range of ultra-violet radiation, namely those from 2800 Å to 3300 Å, are responsible for his coat of summer tan. In other words, these rays are absorbed by the skin, and they disappear in chemical activity, just as certain light rays are used up in photo-synthesis when sunlight shines on a blade of grass. We have visual evidence of the production of the skin-pigment, melanin; but other chemical changes are caused by ultra-violet rays, and not all such changes result in the production of pigment. There is, for example, the formation of vitamine D which gives evidence of its presence by its tonic effect on metabolic functions, but which does not make its presence known to our vision as does melanin. There may be yet other chemical results of sunshine. Indeed, a considerable portion of the ultra-violet from the sun may be expended in chemical activity.

FLUORESCENCE

Now let us see what happens if our life-guard on the ocean beach takes to the use of skin cream. That certain ointments and cold creams effectively prevent tanning is well known. Obviously, these preparations must intercept, that is, must absorb, the pigment-producing rays. If so, there must result chemical action, or, if this is not the case, there must occur a lengthening of the wave-length, comparable to the effect noted in connection with the black paint or soot on ice. There is, however, this difference: if light rays are lengthened, invisible heat rays result; but since ultra-violet rays are shorter than light rays, their "step-down" may involve the production of wave-lengths which fall within the range of the visible spectrum, and thus out of invisible light there might come visible light. Now this is precisely what happens when ultra-violet rays are absorbed by a tan-preventing skin cream. We may prove it by means of our ultra-violet lamp, provided with a filter to intercept visible rays and passing only the invisible rays. Under such radiation the skin cream becomes luminescent. It appears that the invisible radiation has set up a disturbance in certain components of the skin cream resulting in the emission of wave-lengths which our eyes can

perceive, and thus the ultra-violet rays have lost the characteristics by virtue of which they produce skin-pigment. They have ceased to be ultra-violet rays. They are now visible light rays, with the properties of such rays, and without the properties peculiar to the shorter ones denominated invisible light.

WHAT CAUSES FLUORESCENCE?

Scientists have given much thought to the astonishing phenomenon of luminescence, or fluorescence, as it is commonly called, involving the stepping down of invisible to visible light by certain substances. How does this happen? Why do certain chemicals function in this manner while others do not? The answers to these questions are not very satisfactory. But let us bear in mind that we do not as yet understand fully why a pigment shows its characteristic color by selective absorption of certain wave-lengths and the transmission and reflection of other wave-lengths. As regards fluorescence, the hypothesis generally given connects the phenomenon either with the peculiar rotation of the molecule, or with the vibrations of the atoms within the molecule, or with the orbital displacement of electrons within the atoms, the assumption being that the impinging radiation effects their displacement, and that when the electrons drop back to their proper orbit or shell, they set up a radiation in a longer wave-length. Thus there may be at least three ways in which a substance may emit light rays when it is irradiated with invisible light. Fortunately we need not explain fluorescence before we can make practical use of it. We need but know certain facts, and with these as a basis we can make progress pending the time when science can give its final answer to the question how a chemical actually functions when it converts invisible wave-lengths into longer ones which we can see. Let us say simply that fluorescence is an induced emission, induced by ultra-violet radiation.

FLUORESCENCE COLORS

At this point we may with profit hark back to the statement that white light is made up of a span of wave-lengths, namely from about 3700 Å to about 7700 Å, and that its component colors embrace a range of wave-lengths. If now a substance under ultra-violet radiation emits all the wave-lengths from 3700 Å to 7700 Å, and in the proportion in which they occur in daylight, the fluorescing substance will appear white. Teeth, bones, and the whites of our eyes, emit white light

under such conditions. Teeth, under ultra-violet rays are surprisingly white, whiter than in daylight, whiter in fact than we see them in a toothpaste advertisement. But a relatively small number of substances exhibit white fluorescence. More often there is color, which means that the range of wave-lengths of the emitted rays from the fluorescing substance represents but a portion of the visible spectrum. Thus a fluorescing substance may appear red, yellow, green, blue, or violet, and its fluorescence color is an inherent property just as is its color, or the lack of it, in daylight. As a consequence, the appearance of a substance under ultra-violet may give a clue of its identity, and one substance may be distinguished from another, even though this be impossible in daylight. White lead, zinc white, chalk, and titanium oxide look very much alike in daylight; but not under ultra-violet radiation. Two dyes may appear to be of the same shade of red, but when we look at them by invisible light the one may be dark and the other a brilliant orange.

DELICACY OF FLUORESCENCE TESTS

The quantity of a substance required to produce an observable fluorescence effect is in some cases surprisingly small, and dilutions of 1 part to a million may disclose the presence of the fluorescing substance under ultra-violet light, and without the employment of tedious separation processes. Thus there is made available to the chemist a new technique in the detection of adulterations and admixture, and also of minute quantities of impurities.

OTHER ADVANTAGES

There are several advantages attached to the employment of fluorescence as a means of identification, or for the purpose of distinguishing between one substance and another. There is, first of all, the time factor. When conclusions are based on color, such conclusions may be arrived at "on sight", just as we distinguish between a ripe and an unripe banana, or draw our inference from the color of a man's nose. Secondly, no preparation of the material is required. All we need to do is to look at our substance under the ultra-violet lamp. Third, which is most important in certain cases, examination of a substance under the ultra-violet lamp does not destroy the material or make it useless for other chemical tests, or for other purposes. At least this holds true when the exposure to the ultra-violet light is of short duration.

TYPE OF ULTRA-VIOLET LAMPS

We have various types of ultra-violet lamps. There is the well-known health lamp, intended for therapeutic use in the household. This type of lamp is designed to replace sunshine, and to furnish the ultra-violet rays which are operative in producing vitamine D by their action on the sterol-like constituents in the skin tissue. Such a lamp cannot satisfactorily be employed in fluorescence tests. There are also lamps of the carbon-arc type, or with carbons impregnated with iron or some other metal, which are capable of furnishing a wide range of ultra-violet radiation, including the waves shorter than 2000 Å. This is the type preferred when the ultra-violet rays are to be used in causing or in accelerating chemical change. But when the lamp is to supply the radiation for fluorescence the quartz tube mercury-arc lamp is a favorite. This lamp must, of course, be provided with a filter to intercept the visible light emitted by the mercury vapor arc. The filter, being of glass of special composition, and embodying nickel and possibly other metallic coloring agents, intercepts also some of the ultra-violet radiation, thus cutting down the intensity, and indeed, cutting out certain wave-lengths altogether, mainly those shorter than about 2800 Å. We can readily understand, now why a filter is not employed when the ultra-violet radiation is used to kill bacteria, or when it is used to cause or to speed up chemical changes. But for fluorescence work the filter is essential, and is always employed. This means that our data concerning the fluorescence of substances pertains generally to ultra-violet radiation of wave-lengths ranging from 2800 Å to the visible spectrum, that is to about 3700 Å.

MINERALS UNDER ULTRA-VIOLET

When we examine minerals under such radiation we find that certain ones, particularly, fluorite, calcite, and willemite, exhibit rare beauty of color; the fluorite is colored violet blue, the calcite cherry red, and the willemite shines with a yellowish green light. These three minerals thus cover, in their fluorescence, the whole spectrum from red to violet. We cannot explain why calcite steps down the ultra-violet to light of wave-lengths in the neighborhood of 7000 Å, while fluorite yields much shorter waves, those of violet and blue. We know only that each functions in this particular manner. Sometimes the fluorescence of a mineral is due to the presence of an impurity, in which case different samples of the same mineral may differ in color under ultra-violet

light. It is, however, unnecessary to employ this radiation to identify minerals.

INORGANIC CHEMICALS

Inorganic chemicals are, speaking generally, not striking in fluorescence effect. Some, however, are. The uranyl salts, which show a brilliant green, and the double salts of the alkali metals and of platinum, are such notable exceptions. Calomel appears brick red and a very small amount of this mercurous salt as a contamination of corrosive sublimate, can be detected instantly. Strange to say, when calomel is heated, it loses its power to fluoresce, but regains this property on cooling.

ORGANIC CHEMICALS

In organic chemicals the property of showing fluorescence is so common, and possessed by so many compounds of this class, that we seldom can depend on this characteristic to establish identity. We may, however, use it in disclosing a suspected admixture or impurity. Thus we can detect small quantities (about 1 per cent.) of acetone in alcohol; traces of benzoates or salicylates in food products. One may tell also, at a glance, whether a confection contains coumarin or vanillin, and if a cologne contains oil of neroli.

Most alkaloids fluoresce strikingly, which makes their detection possible even though the quantities present be exceedingly small. Thus quinine sulphate shows its presence in the saliva for several days after the last dose has been taken, shows it by its bluish fluorescence, while fluorescein may be detected in solution of 1 part to a million.

Many of the coal tar products fluoresce; naphthelene, anthracene, phenol, hydroquinone, pyrogallol, beta-naphthol—and scores of others. Anthracene, in chloroformic solution, shows a purple color, while the anthracene in crystals shows green. A striking effect is produced under the ultra-violet when anthracene solution is allowed to evaporate to dryness from filter paper.

Fixed oils, fats, and waxes exhibit characteristic fluorescence colors, which fact may be utilized in their examination for purity as well as for their identification. The same holds true for a number of the volatile oils. Lubricating oils from petroleum, and also petrolatum, are strikingly fluorescent.

CRUDE DRUGS

Many crude drugs fail to show characteristic colors under ultra-violet. There are, however, a few which do give beautiful color-effects. The most conspicuous drug under this radiation is hydrastis, which glows like burnished gold. It is interesting to note that its synonym is golden seal, a name chosen long before anything was known about the golden-yellow fluorescence of this drug. The rootlets, as well as the rhizome show the effect, but only upon fracture, for the epidermal tissue absorbs the radiation without the show of color. The golden glow of golden seal is due to the alkaloid berberine. The other alkaloid, hydrastine, appears white, like snow does in certain light, namely white with a faint suggestion of blue. Speaking of vegetable matter in general, and of drugs in particular, it is important to bear in mind that the fluorescence observed may be due to a single constituent. If this constituent is peculiar to a single drug, the fluorescence has diagnostic value. If, however, the fluorescence is due to a constituent which is common to many drugs, we must draw our conclusions with great caution. As a case in point we might mention chlorophyll, which is, of course, present in all leaf-drugs. Now chlorophyll, when it has been extracted without chemical transformation, and has been taken up in aqueous ether, shows a beautiful red color—a rose red. But such a color effect under the ultra-violet could not be used to distinguish between peppermint and spearmint, uva ursi and buchu, digitalis and belladonna, for all green plant substances would give the same color, as all contain chlorophyll.

BLOOD STAINS

The chemist sees a relationship between the green pigment of plants and the red pigment of blood. It is interesting in this connection to note that under the ultra-violet the chlorophyll solution looks like a high dilution of blood. It is of further interest that while blood does not fluoresce, it can be made to do so by treatment with concentrated sulphuric acid, and subsequent dilution with water, when it develops a rose-red fluorescence indistinguishable from that of chlorophyll. This fact has been utilized in the detection of blood spots.

FLUORESCENT INDICATORS

Some fluorescing substances, as has been stated, may lose this property on heating, or on undergoing solution; others may lose it in the presence of an excess of acid, or they may exhibit it under acid conditions, and lose it in the presence of excess of alkali. Quinine is such a substance: blue in

acid solution, and colorless in alkaline liquids. Indeed, this alkaloid has been employed as an indicator in volumetric analysis, the procedure being, of course, carried out under ultra-violet radiation. Another substance affected by acids and alkalies, and hence useful as an indicator, is umbelliferon, a constituent of the gum-resin galbanum. This interesting plant principle is fluorescent in alkaline solutions, showing an intense greenish luminescence, which effect disappears when the alkali has been neutralized with acid. Umbelliferon has been used in the titration of dark fruit juices, in which cases the ordinary color-changing indicators are useless, as their colors are obscured by the deep colors of such juices. Umbelliferon seems to be fairly permanent, remaining unaltered in medicinal mixtures through long periods of time. A sample of a very old plaster, containing galbanum, found in the collection of the Philadelphia College of Pharmacy and Science, and made by students probably prior to the Civil War, was found to disclose its umbelliferon content to the ultra-violet lamp.

IN PLANT HISTOLOGY

In pharmacognosy and plant histology, the ultra-violet lamp may at times be employed to advantage to show where certain constituents occur in the plant tissue. If, for example, a cross section is cut from a twig of the horse chestnut tree, the aesculin discloses its presence in the inner bark by its brilliant fluorescence, and one may see at a glance that this plant principle is not uniformly distributed throughout the plant tissue.

FOODS

An extremely interesting use of the ultra-violet lamp is in connection with the examination of foods. Not only may it be used to distinguish between the genuine and the spurious, the pure and the adulterated, but it may be employed also in some instances to determine whether the foods are fresh or stale, this being possible because the chemical changes which certain foods undergo on keeping alter their fluorescence under ultra-violet light. Fish, for example, show such changes under the invisible light before phosphorescence develops, and before a putrescent odor may be observed. The lamp shows before the nose knows.

OTHER APPLICATIONS

There are countless other applications of the ultra-violet light. Thus one may distinguish, at a glance, between silk and artificial silk, ivory and celluloid imitation, white lead and zinc white, precious stones and paste, bees-

wax and cerasin, true parchment and parchment paper, natural teeth and store teeth—if circumstances justify the disclosure.

CHECKS AND PAPER MONEY

The modern banker may employ the invisible light to determine whether a check which is under suspicion has been raised, whether a five-dollar bill is Uncle Sam's own production, or is counterfeit. To understand how light may be thrown upon the genuineness of paper money, checks, and documents, it is but necessary to know that practically every variety of paper stock has a fluorescence which is characteristic, dependent upon the sizing, the mineral filler, and other constituents found in modern paper. Thus resin, casein, and glue contrast with each other, and so do the various mineral substances employed as paper filler. Moreover, the inks, even those which appear to be of the same color in daylight, are readily distinguishable under the ultra-violet lamp. And as for altered checks, these may be spotted at once, for not only do erasures, even clever ones, become quite conspicuous, but bleaching fails to achieve its purpose, for the ink which has been made to disappear, shows up under ultra-violet light. A check which has been subjected to a clever bleaching operation, so that a higher number may be inscribed, need not fool an up-to-date banker.

IN CRIME DETECTION

And in a similar way, the art collector may now use the ultra-violet lamp to determine whether a painting offered as the work of one of the old masters, is that in fact, or is a clever copy. We can imagine also how A. Conan Doyle could have found use for the ultra-violet lamp in connection with crime detection in his Sherlock Holmes stories. Indeed, not only in fiction, but in actual practice the ultra-violet lamp has become a tool for the modern detective.

CONCLUSION

And all these uses of the ultra-violet lamp, as well as many others which we cannot here enumerate, hinge upon the fact that certain chemicals function characteristically when they are subjected to the ultra-violet rays comprising the wave-length from about 2800 to 3700 Å, rays which are not visible, but which by these chemicals are stepped down to longer wave-lengths, resulting in the appearance of color, a phenomenon known as fluorescence.

CASCARA

By T. J. Starker, Professor of Forestry, Oregon State College, and A. R. Wilcox, Forest Examiner, U. S. F. S.

(To be continued in the March issue.)

Introduction

FOR THE LAST five years the cascara tree has been under observation by the faculty and senior students * at the Oregon State College, and it is the purpose of this bulletin to bring to the attention of collectors of bark, loggers and land owners the information thus secured.

Cascara (Rhamnus purshiana, De Candolle), was discovered on the banks of a tributary of the Columbia River about 1805 by members of the exploring party of Lewis and Clark. It was first noted on the California coast in 1816 by a Russian naturalist, Eschscholts. Since 1875 it has been grown under cultivation at the Arnold Arboretum. The tree is claimed to have been known to the Mexican and Spanish priests of old California, since the early part of the nineteenth century. It was known by the Spanish name Cascara Sagrada (sacred bark), because the wood was supposed to be identical with the "Shittim or Chittim" wood used in the Arc of the Covenent.** The same wood was also said to have been used for dowel pins in the construction of King Solomon's temple.

Names

Much confusion has resulted because of the fact that many common and localized names have been applied to this tree. Some of these are buckthorn, "wahoo," (Indian origin), bearberry, barberry, bearwood, bitter bark, coffeeberry, coffee tree, chittim wood and

*Considerable work was done by four senior students, James Mielke, George Spaur, Paul Case, and Curtis Price, under the supervision of the author, and credit is hereby acknowledged. Much of the information herein contained is taken verbatim from the seminar reports.

Acknowledgment is also made of the valuable assistance of Thornton T. Munger, I. P. Callison & Sons, Dr. Henry M. Burlage, Prof. Justin L. Powers, Allan K. Moody, R. S. Shelley and others in the compilation of the data contained in this manuscript. Some of the cuts used in illustrating this paper were furnished by the Oregon State College and *The Timberman.*

**Numbers indicate references at end of Bulletin.

shittim tree. John L. Davidson,[20] botanist of the University of British Columbia, says, "The fact that the true bearberry (Arctostaphylos uva-ursi) and two species of barberry (Berberis aquifolium and Berberis nervoso) are also of medicinal value, is not generally known. In appearance they cannot be confused, having no resemblance to each other."

"The Cascara tree, being deciduous, that is, having leaves that fall in autumn, cannot be mistaken for either bearberry or barberry, which, as before stated, are evergreen, and it is highly desirable that the application of those names to the cascara tree should be discouraged and discontinued, so that no misunderstanding may arise between manufacturing druggists and collectors of bark."

The specific name given to this tree by De Candolle commemorates the botanical labors of Frederick Pursh, who first described the plant.[18]

Species

There are several species of the genus Rhamnus, of the Rhamnaceæ or buckthorn family. These species are distributed widely over the world, being found on four continents.

1. *Rhamnus cathartica,* L., the buckthorn, ranges over northern Africa, most of Europe, the Caucasus, and into Siberia. The maximum size of this species is eight inches in diameter at the base of the trunk, and, on the better sites within the range, becomes a small tree. This species is also characterized by the presence of stout thorns on its branches. A drug from the bark of this tree was used as a laxative in England at an early date, under the name of Waythorn or Hortshorn. The date of this early use is not known. A yellow dye is also made from the bark. This tree has become sparingly naturalized in the eastern part of the United States.

2. *Rhamnus frangula,* L. (alder buckthorn), is distributed over Europe. This species is distinguished from Rhamnus cathartica by its entire leaves, absence of thorns, and its tree-like form. The leaves are broadly ovate in outline, obtuse at apex, entire or slightly sinuate along the margin. The fruit is a purple drupe. The bark is used for a yellow dye; the wood is prized in the manufacture of gunpowder, while the fruit is employed in the practice of veterinary medicine.

3. *Rhamnus caroliniana,* Walter, also called Rhamnus saxatalis, is another species, the bark of which is sometimes substituted for that of Rhamnus frangula. It is known locally as yellow buckthorn, and grows from Virginia to Florida and west to Eastern Kansas, Oklahoma, Southwestern Arkansas and Eastern Texas.

4. *Rhamnus crocea,* Nuttall (hollyleaf buckthorn), is distributed through the coast mountains from the central to the southern part of California.

There are three varieties of this tree given by Sudworth, namely, R. c. ilicifolia, R. c. pilosa and R. c. insularis.

5. *Rhamnus purshiana,* De Candolle. This species was formerly called Rhamnus cathartica (buckthorn berries) at a date probably about 1820 or 1825. In 1890 the name of Rhamnus purshiana was officially adopted for the tree, and cascara sagrada was the name adopted by the materia medica at the same time. Sudworth in his "Check List of Forest Trees" gives the following common names: Shittim wood (Oregon, Idaho and Washington), cascara sagrada (California and Oregon), bearberry (Oregon, California, Idaho and Washington), bearwood (Oregon), cascara (Idaho), wahoo (Oregon), chittim (Oregon), chittim (Washington), cascara buckthorn (trade and hort.), yellow wood (Oregon), buckthorn (Idaho), pigeon berry (Idaho), Oregon bearwood (Oregon and Washington), coffee berry (California), wild coffee bush (California), bitter bark (lit.), western coffee (Oregon and California), bayberry (Oregon and California), wild coffee (California), California coffee (California), coffee tree (lit.).

Distribution

Rhamnus purshiana is widely and very generally distributed from the region surrounding Puget Sound, southward to Central California; it extends along the mountain ranges of Northern Washington to the Bitter Root Range in Idaho and the shores of the Flathead Lake in Montana. It occasionally occurs on the eastern slopes of the Sierra Nevada Mountains and reappears on the mountains of Colorado and Western Texas. In one of its forms, it is scattered through the mountainous portions of Southern California, Arizona and New Mexico.[18] See distribution map.

The commercial range, however, is much smaller in extent, being confined to Northwestern California, Western Oregon and Washington and Southern British Columbia.

RANGE OF CASCARA.

Commercial production of cascara bark extends from Eureka, California, on the south, to Campbell River, Vancouver Island, B. C., on the north. The principal production in California comes from the Lower Klamath River, the plateau back of Crescent City and the slopes of the Requa and Orick Rivers. The amount produced, however, is small relative to the total production and will never become a serious factor. The Crescent City region produced some bark previous to 1924, but in that year I. P. Callison & Sons started to develop this market to a considerable extent.

Commercial trees grow south of Eureka, but sparingly. The species, however, is found far south of San Francisco in the form of a small bush.

In British Columbia the tree, in commercial quantities, is limited to two districts; the Lower Frazier River Valley from Yale, west, and the eastern slope of Vancouver Island from Victoria to Campbell River. Sizable trees may be found at the head of inlets along the coast of British Columbia as far north as Prince Rupert and scrubby trees and bushes as far north as Cordova.

By far the largest per cent. of the bark is gathered in Western Oregon and Washington. The tree attains its best development and is found in greatest abundance in these two states. Outside of its commercial range, cascara grows shrublike in form, possibly due to climate, soil and other site factors, and does not yield a bark of such high chemical constituents as when grown under optimum conditions. Because of this shrublike form and modifications in leaf shapes and structure, the species has been split up into three or four varieties which are covered elsewhere.

Description

Size. Heights up to sixty feet have been recorded, but usually it is a tree twenty to forty feet in height and six to fifteen inches in diameter, although it has been known to attain a diameter of two and one-half to three feet. The largest cascara tree thus far recorded grew on the banks of the Skagit River directly across from Rockport. It was three feet in diameter, sixty feet high, well proportioned, and yielded almost a thousand pounds of green bark. Under a Montesano, Washington, date line. the July 12, 1929, *Oregonian* carried a story of a local peeler bringing in a piece of bark from a tree sixty-six inches in circumference. He offered five dollars to anyone who would match it or exceed it. Supervisor R. S. Shelley, of the Siuslow National Forest, reports that trees of approximately twice this size have been peeled on his forest.

Form. It is quite variable in form depending upon its range and occurrence. Typical open-grown trees have a short trunk and thick bushy crown, while forest-grown trees have a long slender bole and a crown much less dense, the stem being clear of branches for fifteen to twenty feet. In dryer situations it is often small and shrublike in form.

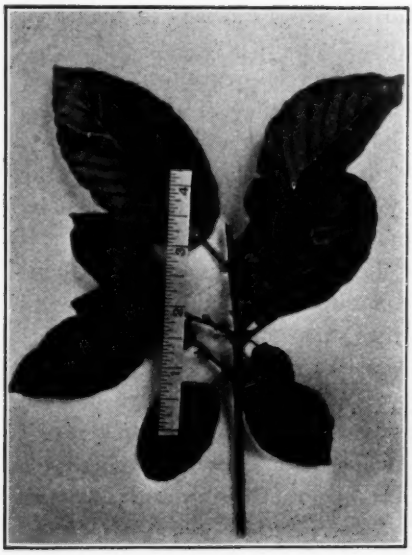


Fig. 2—Leaves and Flowers of Cascara

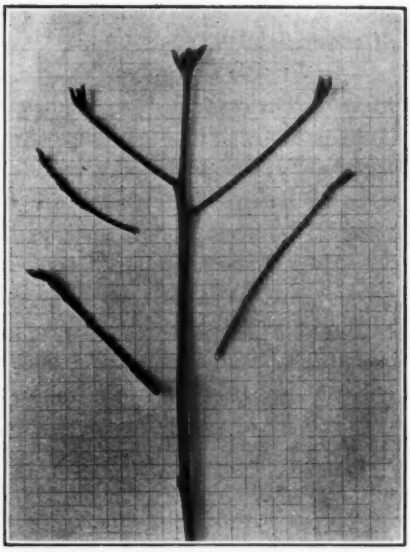


Fig. 3—The Open Winter Buds of Cascara

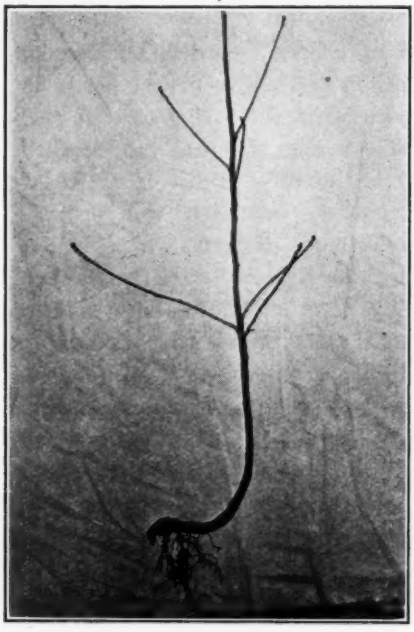


Fig. 4—New Plant From Layering

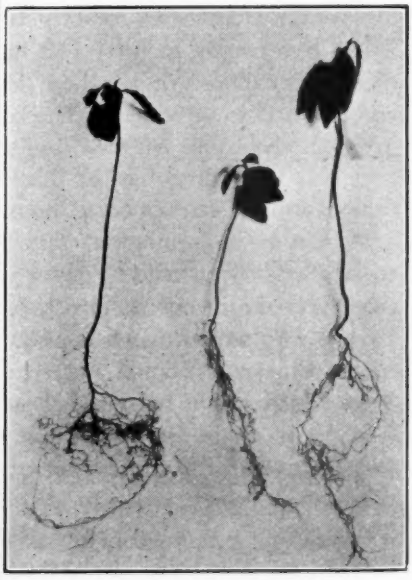


Fig. 5—Seedlings of Cascara Showing Root Growth

Leaves. The leaves (see Fig. 2) are deciduous with the exception of seedlings, which retain their leaves the entire year. The arrangement of the leaves on the stem is alternate. Mature leaves are broad-elliptical, obtuse or bluntly pointed at the apex, rounded or slightly cordate at the base, finely serrate, or often nearly entire, with undulate margins, thin, villose, with short hairs on the lower surface and on the veins above, one and one-half to seven inches long, one and one-half to two inches wide, conspicuously netted-veined with a broad and prominent midrib and primary veins.

Flowers. The flowers (Fig. 2) which appear in May and June are small and five petaled, of a greenish color, and are borne in clusters near the ends of the branches.

Fruit. The mature fruit is round, one-third to one-half inch in diameter, smooth and black (previously red) with juicy, rather thin, sweetish pulp which contains two or three hard, smooth, olive green seeds. When there are two seeds they are flat on one side like a coffee grain and when three, they are triangular. The bottom end of the seeds is notched and the top end rounded. The fruit matures in one season (usually in the late summer), and is greedily eaten by birds and mammals, without injury to the seeds. The seed is thus carried long distances from the parent tree and the large amount of reproduction found along fence rows is thus accounted for.

It has not been determined at what age cascara begins to produce fruit, but it is estimated to be between five and seven years. If it becomes necessary to grow this tree commercially the cascara grower may be able to secure additional revenue from the sale of seed. There is also the possibility that the seeds can be used in the same manner as the bark. Cascara is a prolific seeder, heavy crops of seed being borne nearly every year. In one case twelve pounds of seed were taken from an open-grown tree, fifteen years old and four inches in diameter, breast high, and it was estimated that an equal amount was left on the tree. By actual count it was determined that there are approximately 10,000 clean, dry seed per pound.

Buds. The cascara is the only known deciduous tree on the coast, the buds of which are not covered by bud scales. The under side of the young leaves has a coat of fine, rusty brown hairs (Fig. 2), which protect the young leaflets as do scales in most broad-leaved trees. These buds afford an absolute means of identification even in

the winter. This, together with the fact that seedlings retain their leaves the entire season, makes it very easy to identify the young trees in the forest during the early spring. This characteristic can be used for identification when seedlings are desired for either nursery or field planting. Seedlings have been gathered near Corvallis during late February and no difficulty in identification was encountered.

Bark. The bark of the trunk is usually about one-tenth to two-tenths inches and rarely one-quarter inch in thickness. The color ranges from dark brown to light brown or gray tinged with red, but usually has somewhat of a grayish appearance caused by lichens and moss which commonly cover its surface. When freshly cut, the inner surface is of a bright yellow color. It becomes somewhat darkened on exposure to light, has a bitter taste when chewed and colors the saliva yellow. When the bark is wrapped in white paper, the yellow color (due to the presence of frangulin) is transmitted to the paper. Dry bark, when broken, snaps with a clean fracture. A series of tests on bark from six different trees indicates that the bark has a specific gravity of .85.

Roots. Cascara is not a deep-rooted tree and has little, if any, tap root, except on very porous, well drained soil. Seedlings have a well developed, fibrous root system (Fig. 5), making them a desirable tree for transplanting. The transplanting of seedlings in the nursery greatly stimulates the plant to produce a very bushy root system with many small rootlets. This has been very nicely shown by an experiment with wild stock transplanted at the Oregon State College forest school nursery. The wild stock, which was about six to ten inches high, was spaced three inches apart in the rows and six inches apart in the nursery bed. They were left in the bed for nearly one year, at which time they were found to have a root system that was too large to plant easily in the field. (Fig. 4.) Several reports have been received of successful attempts of transplanting from the wild state.

Wood. The wood is moderately heavy, ring porous with diffuse porous tendencies, firm, but brittle, rather coarse grained, brown tinged with red, the thin sapwood being lighter in color and tinged with yellow. The specific gravity of the absolute dry wood is 0.5836, making a cubic foot weight of 36.37 according to Sargent. This is slightly higher than that shown by the following table. At present

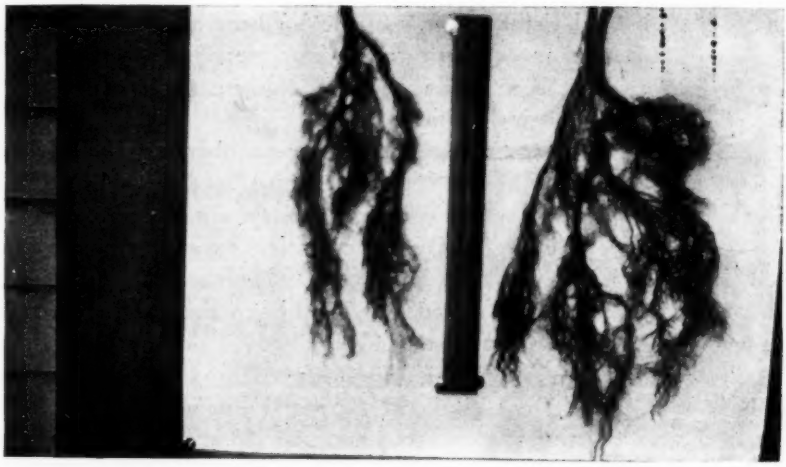


Fig. 6—Showing Characteristic Root System of Transplants

Fig. 7—View of Cascara Experimental Plot in 1926 at Corvallis, Oregon

it is of little economic value, but has been used for spokes, handles, fence posts and cheap furniture.

It has been reputed that cascara fence posts are more durable than cedar, but this is an error. In the Willamette Valley, cascara posts do not last for more than three or four years. A small number of this species have been placed in the Oregon State College "post farm" to determine their durability.

A small experimental charge of cascara lumber, after receiving a preliminary steaming to heat it through, was placed in a commercial kiln in which the temperature varied little from 165 degrees F. All the boards came out in satisfactory condition excepting one board containing the heart or pith of the tree. This piece split at one end and warped considerably. Undoubtedly this species could be dried on a schedule similar to that for white oak.[25]

The following is a comparison of tests made by Forest Products Laboratory (U. S. D. A. Bulletin 556) and similar tests made by Curtis Price, a senior student, to determine strength and shrinkage of cascara wood at different moisture content.

Experiment by	Rings per Inch	Moisture Content	Shrinkage green to oven dry Rad. %	Tang. %	Modulus of Rupture # per sq. in.	Compression strength parallel to grain # per sq. in.	Weight per cu. ft. oven dry
F. S. Lab.	17	61	3.2	4.6	6,300	3,270	34.4
Oregon State	3	50	2.8	6.4	6,900	2,850	34.8
F. S. Lab.	17	4			10,500	9,190	
Oregon State	3	4				12,400	

The wide difference between the two series of tests is probably due to the large difference in the number of rings per inch, seventeen and three. If grown under management, with full light on the better sites, the smaller number of rings per inch will probably be attained in most cases.

Growing as it does in isolated and scattered stands, the wood is not used commercially. When grown under management, however, in accessible situations, it should prove quite profitable to utilize the wood after it has been peeled. Its hardness, pleasing grain and the ability to take an excellent polish should make it very desirable for

Fig. 8—Method of Transportation From the Woods to Drying Ground
Fig. 9—Starting to Peel a Tree in Typical Cascara Region
Fig. 10—Drying the Bark on Improvised Racks

furniture and small articles of turnery. Its high fuel value makes it quite valuable for heating purposes.

The following table taken from U. S. D. A. Bulletin 753 shows the heating value of cascara and some of its common associates. The species are arranged in order, those having the higher heating values being placed first.

"Heat Values of Cordwood, Based on Forest Products Laboratory Experiments. Assuming 7350 B. T. U. available per pound of dry wood with flue gases at 300 degrees F."

Species	Available heat units per cord cord of 90 solid cu. ft. (Millions of B. T. U.) Air dry	Green	Per cent. of short ton of coal value Air dry	Green
Oregon white oak Quercus garryana	25.3	23.4	97	90
Pacific dogwood Cornus nuttallii	22.4	21.4	86	82
Cascara Rhamnus purshiana	20.2	18.6	78	72
Oregon ash Fraxinus oregona	19.7	19.0	76	73
Big-leaf maple Acer macrophyllum	17.7	16.3	68	63
Douglas fir Pseudotsuga taxifolia	17.7	17.3	68	67
Western hemlock Tsuga heterophylla	15.0	13.5	58	52
Red alder Alnus rubra	14.8	13.0	57	50
Northern black cottonwood Populus trichocarpa hastata	12.8	10.5	49	40

The above table proves quite conclusively the value of cascara as a fuel wood.

As mentioned elsewhere, there are possibilities of grinding the twigs and securing the medicinal principle from this source. This

product should rank high because of the very thin bark which yields a larger proportion of medicinal properties than thick bark. Professor John Davidson, botanist in charge at the University of British Columbia, has perfected a method of extracting the principle from the wood of the tree. This extract meets the standards required of bark extract and has given comparable results when tested in hospitals. He writes as follows: "I was anxious to know if we could obtain medicinal properties from the wood, and after various methods of treating the wood (shavings, chips and sawdust) we found that cascara extract was present in the wood in approximately the proportion of one-fourth of that found in the bark. This showed us that there was more cascara lost than was collected from the bark, although the drug is only present in one-fourth the proportion we found that for every pound of bark collected there was much more than four pounds of wood wasted." He further suggests that the tree be cut like cordwood and then run through a wood hog before extraction starts.

Medicinal Value

Professor Justin L. Powers, of the School of Pharmacy, Oregon State College, says, "Although species closely related to cascara sagrada have been used as cathartics from a very early date, it is only within comparatively recent times that this drug has come into general use. Among the related species which it has largely replaced are Rhamnus cathartica and Rhamnus frangula."

"Without doubt cascara sagrada was first used by the American Indian from whom its virtues were learned by the Spanish priests of old California. Since being introduced to the medical profession in 1877, there is probably no single drug which so quickly attained popularity as did cascara sagrada. That this popularity was deserved is shown by the fact that it is still held in high esteem and has in a large measure replaced several similar drugs of our materia medica."

"The first publication concerning the medicinal value of cascara sagrada was that of Dr. J. H. Bundy, of Calusa, California, in 1877. To commercial drug firms belongs the credit of first offering a legitimate preparation of the drug to the medical profession immediately following Dr. Bundy's publication."

"The extended use of cascara sagrada during a period of over fifty years, and numerous investigations have not resulted in a

definite determination of the chemistry of its active constituents. In this field lies an unusual opportunity for research."

"For the treatment of habitual constipation due to the lack of functional activity of the intestines or lack of digestive secretions, cascara sagrada has no peer. It is said to be more active and more certain in its action than any one of the closely allied species which are used similarly. In the use of most laxatives, gradually increasing doses are necessary to produce their effect, but this is not generally true of cascara sagrada. It not only increases the secretions of the gastro-intestinal canal, but due to its bitter principle, it acts as a tonic, improves the appetite and digestion, and prevents the constipation which usually follows the use of similar drugs. So marked are these characteristics, in fact, that the dose may be gradually diminished and finally discontinued without the return of constipation."

"The use of cascara other than as a cathartic is impossible at the present time for the reason that this principle causing the purgative action is not known. In fact, the only way in which cascara can be used is in the form of an extract or fluid extract, which includes the bitter principle as well as the cathartic principle. When administered as a fluid extract, it acts as a simple bitter tonic, but the action is always accompanied by the cathartic action. As a simple bitter tonic, it appears to offer no advantages over many other vegetable drugs."

"Since the active principle is not known, there is no method for its extraction. Several different principles have been isolated and in the majority of instances, these are amorphous and resinous in nature. Some crystalline principles have also been isolated, but the structure of none of them has been determined. It is not possible to assign the action of the drug to any of these principles."

Cascara contains glucosides of emodin groups:

Purshianin (decomposes to emodin)
Emodin
Isoemodin
Frangulaemodian
Cascaria
Cascarol
Chrysarobin
Chrysophanic acid

Ferment (which causes griping in fresh bark. For this reason the bark must be aged for a year as the process of ageing seems to break down the ferment).

Resins (bitter, which are claimed to be inert and which may be removed by use of magnesium oxide).

Tannis, 2½%

Volatial oil and fixed oil, 2%

Official preparation are:

Extract of cascara sagrada, U. S. P.—X

Fluid extract of cascara sagrada, U. S. P.—X

Aromatic fluid extract of cascara sagrada, U. S. P.—X

Fluid glycerate of cascara—NF.

Aromatic fluid extract of cascara—NF.

It is alleged that many proprietary remedies and other preparations sold for their purgative and laxative effects have cascara as an important constituent.

The tenth edition of the pharmacopœia of the United States gives the following directions for the manufacture of "Aromatic Fluid Extract of Cascara Sagrada":

Cascara sagrada, in coarse powder	1000.0 gm.
Magnesium oxide	60.0 gm.
Lime	60.0 gm.
Pure extract of glycyrrhiza	40.0 gm.
Glycerin	200.0 c. c.
Alcohol	200.0 c. c.
Gluside	1.0 gm.
Oil of anise	2.5 c. c.
Oil of cinnamon	0.2 c. c.
Oil of coriander	0.1 c. c.
Methyl salicylate	0.2 c. c.
Boiling water, a sufficient quantity to make	1000 c. c.

Slake the lime by the gradual addition of water, mix it thoroughly with cascara sagrada and the magnesium oxide, moisten uniformly with 2000 c. c. of boiling water set aside in a shallow dish for forty-eight hours, stirring occasionally, and then pack in a percolator. Now pour on boiling water and allow the percolation to proceed until

the drug is exhausted. Evaporate the percolate to 50 degrees c. c., and while yet warm dissolve in it the pure extract of glycyrrhiza. When cold, add the glycerin, then the alcohol in which the gluside and the oils have been dissolved, and finally, sufficient water to make the fluid extract measure 1000 c. c.

Alcohol content, by volume, 17-19%.
Average dose—metric, 2 c. c. Apothecaries, 30 minims.

Silvics of Cascara

Soil, Moisture, Light, Climatic and Site Requirements

This tree is apparently quite exacting in its soil and moisture requirements. The best growth is made in deep, rich, sandy, rocky or humus soils in low river bottoms, flats, valleys and borders of streams. In dry, gravelly or sandy soils throughout its southern range, it is shrublike in form. Soils suitable for cascara must be moist, but well drained. The tree will withstand inundation for some time during its dormant season. There is no regularity as to its occurrence in the forest. One drainage basin may have a considerable quantity, while an adjoining location of similar character may be absolutely free of any cascara growth. For this reason no definite figures are available for the total stand remaining in the forest. One timber company, in cruising its holdings of 40,000 acres on the Siuslaw River, found this tree growing on only one section, in sufficient quantity to justify peeling.

Tolerance

The tree is generally found as scattered individuals in the forest, although small patches or groves occasionally occur. It is agreed by most authorities that the tree is exceedingly tolerant of shade in humid air and moist soils, but that it is much less so in drier and exposed situations. The fact that it is a tolerant tree should favor its desirability in commercial plantings where it would be grown in close stands.

Seedlings will germinate and grow very slowly for many years in relatively dense shade, but will not make any appreciable progress unless the canopy is opened. If the dense shade continues, the seedlings will finally be killed. It, however, has the power of recovery

and rapid growth after suppression, which indicates a high degree of tolerance. Under such conditions it is very hard or impossible to peel such trees. It shows intolerance by growing toward openings in the crown canopy and by the slender boled, short crowned form developed where overtopped. The best development is found in close stands with side shade but plenty of overhead light.

The climatic conditions favorable to cascara are similar to those of red alder and Douglas fir, its most common associates. It is also found within its range, growing with western red cedar, hemlock, big leaf and vine maples, Oregon crab and oaks.

Dangers to which it is liable

Cascara is a very hardy tree and has few insect pests or fungus diseases. No fungus, so far as is now known, has been reported as growing parasitically on it, although an occasional tree has been noted with a whitish yellow, wet heart rot similar to that caused by *Polystictus versicolor,* a very common saprophyte. This fungus, together with three others, *Polystictus hirsutus, Schizophyllum common,* and *Stereum,* have been collected from the dead parts of the trunk and branches and appeared to be growing saprophytically, as they usually do, and not parasitically.

No bark beetles are reported as attacking the tree, but the work of the flat-headed borers has been noted in old and damaged trees that were more or less in a weakened condition. Aphis are known to attack the foliage quite severely some seasons. The year 1925 was an especially favorable one for aphis attack in the Willamette Valley and a few trees were noted in a somewhat weakened condition due to these insects. A scale insect, resembling the oyster shell scale, has also been noted in great numbers attacking the bark of a few trees in more or less shaded situations. Where these insects were attached to the bark in abundance, peeling was found to be difficult and some of the bark could not be removed from the tree. More studies should be made on this scale insect, but at present it is doubted if the damage to the tree over its commercial range from this source is of much moment. A small leaf miner was also observed wintering in the leaves of seedlings, but damage from this source is apparently negligible.

Insects of Cascara Sacrada*

The Arizona thrips (*Erythrothrips arizonæ* Moulton)

A dark brown species 2.7 mm. long, wings white with dark border. Feeds on blossoms and buds of cascara in California.

Cascara aphis (*Myzus rhamni* (Fonsc))

A small green aphid which often shows a pinkish tinge. Feeds on terminal shoots and buds of cascara California to Washington.

The Chamise scale (*Lecaniodiaspis rufescens* (Cockl.))

A wrinkled, oval, slightly convex scale, creamy or brownish in color. The males are about half as large as the females which measure 3 to 4 mm. in length. Said to occur in dense colonies in the southwest on chamise and on cascara.

The black willow scale (*Chionaspis salicis nigræ,* (Walsh))

A pure white species often abundant on limbs and twigs of cascara in Oregon, Washington and British Columbia.

The brown day moth (*Pseudohazis eglanterina* (Bvd.))

One of our larger *Saturnidæ,* being two and one-half to three inches across the spread wings. The color is shades of purple, yellow, orange or pinkish, conspicuously marked with wavy lines and spots of black. The caterpillar is two to two and one-half inches long, dark brown to black, with red spots on the dorsal surface. The caterpillar is covered with black and tan spines which are poisonous. Found throughout the west and feeds commonly on cascara.

The cascara pouch moth (*Cystiolcetes nimbosus* (Braun))

This moth has a wing spread of a scant half inch; is gray and white with several tufts of hairs on the wings. The grayish brown caterpillars form pouches by tying together the leaves of cascara which seems to be the sole host plant. The species is widely distributed in California.

Fire and Grazing Damage

Because of its thin bark and shallow root system, the tree is readily killed by fire, which must be excluded if mature trees and reproduction in the forests or plantations are to be expected.

*Data furnished by Prof. W. J. Chamberlin, Oregon State College.

Live stock is apparently the worst enemy of seedlings and small trees. Cattle, in particular, seem to be fond of the foliage. If reproduction is expected and the tree is to be grown under cultivation, cattle and other live stock must be excluded from the planted areas. Small seedlings may be found in abundance in pastures, but few, if any, reach maturity due to the continued browsing by livestock.

Growth

Seedlings

At present there are but meager data on the rate of growth of seedlings. At the end of the first year the plants are about the size of a lead pencil, and because of their shallow roots, can easily be transplanted. At the end of two years they will be from one-half to one inch in diameter at the base and from twelve inches to four feet tall, and when twelve years old these trees will be at least four inches in diameter. According to Stockberger,[1] seedlings reach a height of from ten to fifteen inches the first year, and Johnson and Hindman [17] state that trees grown from seed will have attained a height of from ten to twelve feet in six years.

Forest grown seedlings do not furnish reliable data on rate of growth, because of suppression and competition with other plants during the first years of their life. (See growth curve.)

The following is a table showing the rate of growth of wild stands in the vicinity of Gray's Harbor, Washington,* and Mapleton, Oregon: **

	Grays Harbor, Washington				Mapleton, Oregon			
		Diameters				Diameters		
Age	No. trees	Max.	Ave.	Min.	No. trees	Max.	Ave.	Min.
13	1		4.6					
14	1		5.2					
15	3	6.3	5.5	5.0				
16	4	6.2	4.7	3.4	2	7.6	7.0	6.4
17	2	5.8	5.7	5.6	1		4.8	
18					1		7.6	
19	5	8.2	6.0	4.8	1		5.0	

*Taken from a thesis by Allan K. Moody, prepared at University of Washington.

**Compiled from measurements taken by Ranger E. S. Kerby of the Siuslaw National Forest.

	Grace Harbor, Washington				Mapleton, Oregon			
		Diameters				Diameters		
Age	No. trees	Max.	Ave.	Min.	No. trees	Max.	Ave.	Min.
20	2	5.2	4.9	4.6				
21	2	7.0	6.3	5.6				
22	9	8.4	6.5	3.8	3	4.4	5.7	3.8
23	4	6.6	5.5	4.8	1		4.4	
24	5	8.9	6.6	4.8	2	6.6	6.4	6.2
25	6	10.4	6.9	4.4	3	5.4	4.5	2.8
26	8	8.8	6.5	5.2				
27	10	10.8	6.7	4.8	3	7.0	4.9	3.6
28	10	9.4	7.7	4.0	5	6.6	5.8	3.6
29	4	9.0	7.3	5.0	9	9.2	6.1	3.4
30	5	10.0	6.5	4.3	4	8.0	6.5	5.0
31	4	7.8	5.9	4.4	2	5.8	5.1	4.4
32	6	10.0	8.8	7.0	10	8.4	5.6	2.8
33					7	7.0	5.2	3.8
34	3	6.2	5.6	5.0	3	5.6	5.0	4.4
35	1		13.6		4	7.0	4.8	2.8
36					2	6.8	6.6	6.4
37	1		8.6		1		5.8	
38	2	9.6	8.2	6.8	5	15.0	7.5	4.8
39					1		9.0	
40					1		6.6	
42					1		8.0	
43	2	11.0	9.3	7.6	2	7.4	6.8	6.2
45					2	6.4	5.9	5.4
46					2	5.8	5.6	5.4
47					1		6.2	
48	1		7.8		3	6.0	5.2	4.8
50	1		9.6		1		5.8	
52					2	7.6	6.0	4.5
54					1		9.4	
56	1		8.4					
58					1		13.8	
60					2	15.0	12.4	9.8
79					1		19.0	

Coppice

Trees cut during the early part of the summer have produced sprouts about four feet in height by the end of the growing season of that year. One old stump about seven inches in diameter produced over forty sprouts. Twenty-eight of these sprouts were one inch

or over in diameter and ranged in size up to three inches. The highest of these sprouts was about twenty-two feet. Measurements showed that the largest of these sprouts were twelve years old. Had this coppice been thinned when young, leaving three or four of the thriftiest sprouts, much larger trees would have resulted instead of the thick bush with its numerous slow-growing, slender stems. Coppice that is not thinned will not give reliable data on the growth rate of sprouts.

The growth rate of coppice is much faster than that of seedlings as the former has the advantage, in early life, of the mature root system of the parent tree.

Due to the browsing of livestock and the improper methods of peeling, it was possible to obtain measurements on only a very small number of coppice sprouts. It was likewise difficult to find sprouts which had been properly thinned. The following data pertaining to coppice growth cannot, therefore, be definitely applied to stands under management.

Most of the coppice measured was in thickets along odd fence rows and in brushy places where there was considerable side shade, but full overhead light.

The following table shows the rate of height growth of unmanaged cascara coppice in the Willamette Valley:

Age	*Height*	*Annual Height Growth*
1 yr.	2.5 ft.	2.5 ft.
2	5.0	2.5
3	8.0	3.0
4	10.9	2.9
5	13.8	2.9
6	16.8	3.0
7	19.4	2.6
8	22.0	2.6
9	24.5	2.5
10	26.9	2.4

Although the tallest sprout was used in making the above table, the estimate will still be too low for sprouts grown under management. In a few cases of four-year-old sprouts which had been thinned to leave two or three per stump, the growth rate was 4 to 4.5 feet per year compared to 2.9 feet for that age in the foregoing table.

Several factors will determine the rate which coppice sprouts will attain; (1) season when peeled; (2) condition and age of stump; (3) light conditions and (4) number of sprouts per stump. Trees that are cut late in the season often fail to produce sprouts, or if produced, the sprouts fail to harden off and are killed or injured by adverse weather conditions. Stumps should be left unpeeled, cut low (about six inches), leaving a smooth, sloping top surface. This slope will allow the water to drain and thus retard decay. Low stumps produce stronger, more vigorous sprouts than high ones and less bark is wasted. When the cut stub is overtopped by dense shade as is the case when Douglas fir has grown up around the cascara, the stump fails to produce sprouts more often than when in the open. A certain amount of sunlight is necessary to start the functioning of the adventitious buds.

Coppice as well as seed reproduction is also hindered by grazing of livestock. Goats, sheep and cattle are fond of the young leaves and twigs.

Mature trees

Cascara is not a fast growing tree, but is more or less intermediate in this respect. The trees examined in this study were grown under natural or forest conditions. It is reasonable to expect a faster growth rate, especially during the seedling stage, under plantation conditions.

The following are a few examples of growth rate: One tree growing under very favorable conditions has attained a diameter of ten inches and a height of fifteen feet in fifteen years. One nineteen-year-old tree, growing in competition with vine maple (Acer circinatum), big-leaf maple (Acer macrophyllum), and bitter cherry (Prunus emarginata) on sandy river bottom loam had an average diameter, at six inches from the ground, of 12 inches and a height of thirty-six feet. This is an average annual diameter growth of sixty-three inches and an average height growth of one and nine-tenths feet. For the first eight years the average annual diameter growth was seventy-four hundredths inch. Another tree thirty-three years old, growing on clay loam soil, in the open along an old fence row, was two feet in diameter, at two feet from the ground and thirty-seven and one-half feet in height. The average annual growth was seventy-three hundredths inch in diameter and one and one-tenth feet in height. The crown was large and spreading, having many large, upright branches, typical of the open grown tree.

Ring counts made of forest-grown trees on the Siuslaw National Forest [7] showed an average of from seven to twelve rings per inch depending upon the soil moisture and amount of light received. Cases have been noted where trees grown under shade or on a dry site grow as slowly as seventeen rings per inch. On better sites with plenty of light they may show only three to four rings per inch.

Another tree sixteen inches in diameter one foot above the ground has thirty-six rings. This, perhaps, is approaching the maximum rate of growth. Trees grown under natural conditions show a diameter of about two inches in ten years, six inches in twenty years, eight inches in thirty years, and nine inches in forty years. (See growth curve p. .) Much better growth should be expected, however, from trees grown under cultivation, and especially during the first ten years of their life. The growth of forest-grown trees during the earlier part of their life is very slow, because of competition with and suppression by weeds and brush. This is especially true of trees grown along brushy fence rows and in mixture with other tree species in the forest. Under favorable conditions a diameter of about two inches should be expected in five or six years.

The rate of height growth is shown by the height curve on page . Trees two and one-half inches in diameter at eight inches from the ground will be about ten feet in height; four inches in diameter, fifteen feet; five inches, twenty feet; six inches, twenty-five feet, and seven inches, thirty feet. These figures will perhaps range a little too high for open-grown trees of the larger diameters, but should prove fairly accurate under given conditions for trees under cultivation.

The age and rate of growth of trees used in plotting the growth curves were obtained with the aid of a fourteen-inch Swedish increment borer. The size of this borer made it necessary to make borings about eight inches from the ground. The number of rings per inch were counted and all measurements were made on the radius. All measurements were taken inside the bark, and for this reason no allowance was made in age for height of stump. This allowance should well compensate for difference in seedling growth which was not taken into consideration as eight inches is considered a conservative height for one-year-old seedlings. One-year-old seedlings at the college nursery average two and one-half feet in height, but were irrigated during the growing season. This method of measurement is accurate enough for practical purposes in a study of this kind.

Most of the trees examined were grown more or less in the shade and were associated with other species. The remainder were open grown and were found along fence rows and in pastures. The trees were selected in these situations because the rate of growth under these conditions should correspond somewhat to those in commercial plantations where they would be grown close together.

To determine the age and size attained by forest-grown cascara trees, measurements were taken on peeled areas within the Siuslaw Forest. As these trees were on privately owned areas, they were not peeled under forest service sale regulations and the amount of bark secured is not known. Stumps were cut at any height convenient, up to four feet. Some trees were peeled standing.

Most of the cascara stumps measured were located on a low, well-drained divide, where the cascara was surrounded or intermixed to some extent, with alder. This alder had apparently been suppressing the cascara for several years, though it appeared to have been unrestricted previously. Other measurements were taken from trees found in a thin stand of fir.

Diameter Inside the Bark Inches	Height of Stump as Cut, or Point Where Diameter Was Taken and Ring Count Made Inches	Number of Annual Rings	Diameter Inside Bark at 12″ Above Ground Inches	Number Branches Peeled	Length of Trunk Peeled Feet	Diameter at Point Where Peeling Had Ceased Inches
1.7	12	13	—	4	20	2
4.0	10	41	—	—	36	2.0
4.2	10	39	—	—	32	1.5
5.0	45	45	—	0	43	.75
5.1	42	46	5.4	3	35	1.5
5.2	30	42	5.6	1	24	3.0
5.6	44	23	7.3	—	24	2.0
6.0	12	32	6.0	3	20	2.0
6.3	12	23	6.3	0	33	2.0
6.3	30	50	5.6	1	42	2.0
6.4	36	28	—	4	20	2.0
6.6	34	40	—	0	40	1.5
6.6	18	43	8.0	3	41	2.0
6.7	48	39	8.3	—	—	—
6.8	12	22	6.8	2	33	2.0
6.8	40	33	8.2	3	33	2.0
6.9	42	38	7.8	2	31	1.0
7.0	12	35	7.0	2	20	—
7.1	12	25	7.1	1	32	2.0
8.7	12	38	8.7	3	30.5	2.0
9.7	12	32	9.7	2	38	2.0
10.6	12	26	10.6	6	27	2.0
11.3	12	—	11.3	5	35	2.0
11.4	12	—	11.4	4	26	2.0
14.0	12	—	14	7	32	2.0

From this data it appears that these trees increased in diameter very slowly, probably because of the suppression by surrounding alder. As stated later by Forest Supervisor Shelley:

> "This would seem to indicate that the rate of growth of cascara trees is not at all uniform and that their size is not controlled so much by age as by other factors. . . . these other factors are largely, character of soil, moisture and shade. My own observations indicate that the tree grows quite rapidly under favorable conditions but very slowly under dense shade and in competition with a heavy stand of other deciduous shrubs, and trees, but that it is able to survive for years in such conditions without making any appreciable diameter growth."

In the above table the average width of the annual rings at twelve inches above the ground was found to be .108 inches or slightly more than 1/10 of one inch.

Age Attained

The longevity of cascara has not been fully determined. Four trees, growing on Smith River, ranging in size from ten to sixteen inches, had ages ranging from fifty-seven to sixty-five years. The largest tree had the greatest number of rings.

A tree seventy-nine years old has been reported on the Siuslaw, north of Mapleton. This tree yielded 130 pounds of bark and was nineteen inches in diameter two feet from the ground. This tree was still in a thrifty condition when peeled.

IN MEMORIAM

DR. WILLIAM DUFFIELD ROBINSON

1856—1931

DR. WILLIAM DUFFIELD ROBINSON was born in Fulton County, Pa., March 25, 1856. His ancestry was of Scotch-Irish origin—he was the son of John and Mary (Duffield) Robinson.

He received his early education in the common schools of his county and later graduated from the Chambersburg Academy in 1872—coming to Philadelphia, he graduated from the Philadelphia College of Pharmacy in 1876. The subject of his thesis was "Compound Tinctures of Cinchona." In 1880 he graduated from the Medical Department of the University of Pennsylvania. Beginning the practice of medicine in this city, he was appointed Resident Physician to the Eastern Penitentiary, serving faithfully for many years. On October 22, 1891, he married Elizabeth T. Willian, who with his four sisters survives him.

In 1914 Dr. Robinson was elected president of the Philadelphia County Medical Society and his term of office was characterized by his usual energy in appointing many new committees with definite functions and by the stimulation of greater activity of that body in public health and welfare. The plans he instituted have been continued and developed during the succeeding years.

At the outbreak of the world war he instituted the Senior Military Medical Association with Dr. W. W. Keen as president. This led to the formation of the Volunteer Medical Service Corps of the United States, which was approved by the Council of National Defense in 1918. The object of this corps was to "mobilize the medical profession in the present emergency in order to provide for the health needs of the military forces and civil population of the country." Dr. Robinson was one of the members of the Central Governing Board.

In 1929 Dr. Robinson was elected president of the Alumni Association and later a member of the Board of Trustees of the Philadelphia College of Pharmacy and Science. His service to his alma mater in pharmacy was valuable in that he acted as chairman of the Library Committee and member of the Committee on Education.

He was faithful in his attendance at all meetings of board or committee and his practical advice was deeply appreciated by his colleagues. He was for many years a member of the Board of Trustees of the American Oncologic Hospital. There was one group for whom he had a peculiar affection and whose dinner meetings he rarely missed, namely, "The Sydenham Coterie." The last meeting he attended a few days before his death was the monthly dinner of this organization.

He was a member of the American Medical Association, the Pennsylvania State Medical Society, the Philadelphia County Medical Society, the College of Physicians and the Medico Legal Society, and was treasurer of the Philadelphia Public Health Day Committee and the Better Homes Committee of Philadelphia.

The death of William Duffield Robinson removes from us a man of high professional standards—esteemed professionally and beloved socially. He was spared the disability which overtakes many men before they reach the age which he attained for he was able to pursue his work until a few days before his death.

Nothing emphasizes the paucity of language more than our attempts to pay fitting remembrance to our friends. It is difficult to define personality. Dr. Robinson had a hatred of sham and quackery. His devotion to his patients, his loyalty to his friends, his punctuality in keeping appointments, his indefatigable industry, his philanthropic activities, made him a deeply appreciated and widely beloved member of the profession.

His funeral services were held on Tuesday, January 27th, and the large attendance of his patients and medical and pharmaceutical friends bore eloquent testimony to his splendid qualities. They left those services with a nameless aching sense of loss. A true friend had passed to the great beyond.

W. K.

REPRINTED ARTICLE

THE MICRO-DETECTION OF ALKALOIDS*†

By G. D. Lander, D. Sc.

THE determination of the limits of detectability of poisons is, in general, a matter of academic interest. Improved technique enables one to detect many of them in quantities, or proportions, in themselves devoid of medico-legal significance. But occasions may arise where such data are valuable, in particular, in cases where the quantity of material available for examination is very limited in amount, or when it is desirable to know whether a drug is present or absent, irrespective of any possible physiological effects.

The technique described in this paper has been elaborated for the detection of "limit" quantities of alkaloids in saliva, but is capable, with obvious modifications, of application to other cases in which material is limited.

It has been well known for many years that drugs, after administration in medicinal amounts, find their way into the saliva, and of all body fluids this is perhaps the best adapted for research for alkaloids by reason of its relatively simple organic composition.

The separation of alkaloids in toxicological practice almost invariably follows the lines of the Stas-Otto process, modified *ad hoc* in special cases. The method of isolation and purification here described was devised some twenty years ago by Professor S. Fränkel, of Vienna, to meet the case of saliva.

The material is extracted several times in the cold with 90 per cent. pure alcohol, *plus* about 5 cc. of dilute acetic acid, filtered through a fat-free paper, and the alcoholic extract, amounting to 200-300 cc., evaporated, preferably by distillation in a partial vacuum, to a residue of about 5 cc. of aqueous liquid. This is extracted with ether, which removes traces of fatty matter, and also small proportions of such

*Another paper on this subject, by Professor Eldin Bey, was read and discussed at another meeting of the Society of Analysts. The Publication Committee have satisfied themselves by evidence from various sources, that the priority for the principle of the process rests with Professor Fränkel, and that since then methods based upon it have been in constant use in different European countries. They have therefore asked Dr. Lander to give an account of the method which has, for many years past, been used under his direction.

The Committee wish to thank Professor Eldin Bey for drawing their attention to the subject.—EDITOR.

†Reprinted from *The Analyst*.

purine derivatives as caffeine, and is then evaporated to a "tacky" consistency.

This residue is extracted by rubbing thoroughly with a small rod with successive quantities of gently-warmed absolute alcohol, passed, after cooling, through a small filter, and gives a total of about 5 cc. of extract. This extract is taken to dryness in a small dish, and the residue successively extracted by drops of 1 per cent. hydrochloric acid to give, after filtration, about 0.5 cc. of liquid. Should this solution be at all dark colored, it may be purified by adding a drop of dialysed iron, followed, if no precipitate is given, by a scrap of common salt, and again filtering.

This solution is rendered alkaline with sodium bicarbonate and extracted twice with about 3 cc. of chloroform, and, if considered necessary, with a further 2 to 3 cc. of benzene. After passage through a double paper these extracts are evaporated to dryness, and the residue taken up with successive drops of 1 per cent. acetic acid, to give, after filtration, from 0.3 to 0.5 cc. of final extract.

It now remains to test the final solution, in the first place by general alkaloid tests. The selection of reagents and a suitable technique of testing is a matter of personal choice. I have for many years observed these precipitation reactions in capillary tubes. One draws a small quantity of the solution and then of the reagent into a capillary tube. The formation of a precipitate or opalescence is to be observed at the point of union of the liquids. By allowing the column of liquid to move along the tube each open end may be sealed, and the tube can then be moved to the most suitable position for observation, and, moreover, the positive test can be kept until such time as the bulky precipitate coagulates, shrinks, and, if small, becomes no longer visible.

The economy of material is great. It is easy to deliver as little as 0.005 cc. from a capillary pipette and to observe a positive test therein. Using as much as 0.01 cc., an average final solution gives enough material for forty to fifty tests. Naturally when dilution is pressed to the limit there is room for error from personal bias, but it is very interesting to prepare a "limit" test and a similar blank and submit the pair to the unprejudiced observation of an intelligent layman, the limit of observation being in fact the limit of visibility.

Following are some quantitative data worked out several years ago in this connection. Having regard to the sources of error, due to successive dilution of an original standard, to the errors of measure-

ment inherent in the handling of minute volumes, and to variations in individual acuteness of vision and personal bias, no claim to mathematical accuracy is warrantable. But the figures at least indicate the order of magnitude of the quantities involved, and offer a fair estimate of the relative sensitiveness of individual reagents and alkaloids.

The results are expressed in fractions of a milligram, the actual volumes of solution tested ranging from 0.005 cc. upwards, as measured from a capillary pipette.

Reagent	Alkaloid				
	Cocaine	Strychnine	Quinine	Morphine	Heroine
Iodine	1/20000	1/20000	1/20000	1/100	1/2000
Phosphomolybdic acid	1/20000	1/10000	1/5000	1/1000	1/2000
Potassium mercuric iodide	1/20000	1/5000	1/2500	1/100	1/500
Gold chloride	1/10000	1/2500	1/2500	1/1000	1/2000
Tannic acid	—	1/2000	1/2500	1/50	1/50

The examination of saliva for the purpose of detecting drugs is sometimes of interest in veterinary practice; but clearly, in the case of alkaloids, it is a condition precedent that one must be satisfied that the normal secretion does not contain substances which respond to alkaloid general tests. Out of sixteen cases of normal horses taken from my records, all the general tests tried were negative, save four, which gave very faint opalescences with iodine. Fränkel holds that iodine gives such turbidities with fatty matter, which is probable, since in cases where iodine so behaves, the equally sensitive phosphomolybdic acid gives absolute blanks. A large amount of evidence privately communicated by continental colleagues fully confirms the conclusion that the normal fluid contains no alkaloid or alkaloidal substance.

The identification of an individual alkaloid is here, as in all medico-legal work, a matter for careful consideration, but certain assistance is given by the figures in the above table. For instance, a persistent gold reaction (on dilution) argues for cocaine and against morphine, and it will be seen that morphine and heroine give comparatively weak positives with the general reagents.

One or two notes on the limits of some special tests may be of value. If 0.01 cc. of a 1 in 20,000 solution of strychnine is dried on porcelain and touched with a minute drop of sulphuric-chromate solution, a perfectly definite positive reaction is given, that is, by 1/2000 mgrm. The corresponding sulphuric-vanadic test is not so good.

Marquis' reagent (formalized strong sulphuric acid) similarly gives a perfectly distinct positive reaction with 1/1200 mgrm. of heroine, or of morphine, the Fröhde test being more sensitive but less diagnostic.

If a residue of 1/300 mgrm. of quinine is treated with a minute drop of bromine water and then exposed to ammonia vapor, a positive test is obtained.

In all such limit tests the colors are naturally highly evanescent.

An example from my experimental records will suffice to indicate the nature of the results obtainable. The subject was a light van horse. A control specimen of the saliva gave, in a final solution of 0.4 cc., negative tests with phosphomolybdic acid, iodine, potassium mercuric iodide, and potassium bismuth iodide; after subcutaneous dosage of 0.1 grm. of strychnine acetate a similar sample of saliva in a final solution of 0.5 cc. gave positives with each of the above reagents, and also with picric acid. After evaporation to dryness an undoubted positive was given by the sulphuric acid chromate reaction. On the available quantitative data, and yielding to the very natural desire in such cases to estimate a figure, one may hazard the suggestion that in this case about 1/10000 to 1/20000 part of the original dose was contained in the sample.

But it will be readily agreed that in dealing with the living animal the variable factors of time, age, sex, habituation, idiosyncrasy, channel of administration, etc., render arithmetical generalizations both improper and misleading.

MEDICAL AND PHARMACEUTICAL NOTES

AN UNUSUAL HERBARIUM—One of the proudest possessions of the Philadelphia College of Pharmacy and Science is the Martindale Herbarium, one of the largest and most complete collections of its kind in the world.

The collection was presented to the Philadelphia College jointly by Smith, Kline and French Company, manufacturing and wholesale druggists in Philadelphia and its president, Howard B. French. Howard B. French was a graduate of the Philadelphia College's class of 1870 and served as president of the institution from 1900 to 1921.

The Martindale Herbarium was the life work of Isaac C. Martindale, long a resident of Camden, New Jersey, and was purchased from his estate after his death for presentation to the Philadelphia College. Martindale devoted more than 25 years to the assemblage of this herbarium and the amount of money he expended upon the collection is estimated to have been in excess of $15,000.

The seven large carved walnut cases which house the Martindale Herbarium contain thousands of specimens. Each is mounted on white paper and then is housed in heavy manila paper genus covers.

The specimens are arranged in accordance with Durand's Index and thus correspond with the nomenclature of the Genera Plantarum of Bentham and Hooker.

One interesting feature of the collection is a great number of plants of unusual type and form. Many of these plants, difficult of classification, were sent to specialists and bear hand-written notes of these specialists. Since Martindale's work brought him in contact with the leading botanical minds of his day, it is not surprising to find specimens bearing the labels of such men as Asa Gray, John M. Colter, N. L. Britton, and many others.

Many species are represented by a number of specimens collected in different sections of the country or from foreign shores in order to demonstrate variations within the species. The collection embraces all four divisions of the plant kingdom from algæ to flowering plants.

In exchange for many of the peculiar plants of the Jersey pine barrens, Martindale received representative plants from other parts of the world. Brazil, Germany, England, France, Australia, Africa, China and India are represented.

In addition, plants were obtained by purchase when an exchange could not be effected. The herbarium of Dr. Ferdinand Rugel, which is rich in the flora of the southern states, was purchased in its entirety by Martindale. In a similar way, the collection of Charles F. Parker, who made a special study of the flora of New Jersey, and that of C. F. Austin were purchased and thus are preserved in the Martindale Herbarium.

Martindale's wide acquaintance with noted American collectors resulted in dozens of their specimens becoming a part of his herbarium. Among the distinguished American botanists whose specimens are to be found in the collection are Curtis, Garber, Howell, Lemmon, Palmer, Parry, Pringle, Reynolds, Rothrock, and Rusby.

Thus the Martindale Herbarium is of great value as an authority and as a place of reference. The Philadelphia College of Pharmacy and Science has always been glad to grant visiting botanists and others properly accredited the privilege of using the herbarium for comparison and study.—(*M. S. Dunn.*)

PHOTO-LUMINESCENT TOILET PREPARATIONS—Phosphorescent products have been obtained by utilizing the phosphorescence of zinc sulphide in the presence of traces of copper or manganese. Recent investigations have shown that phosphorescent preparations having cadmium sulphide (in the form of a reddish-orange compound) as their basis, were interesting as regards the intensity of their luminescence and their absorptive power for the more refrangible rays, the violet and ultra-violet rays. These preparations, including in addition different substances, as sodium hyposulphate, zinc sulphate, copper, bismuth, manganese, etc., have this property imparted by the incorporation of a relatively large quantity of cadmium sulphide. The transparency of cadmium sulphide to a portion of the visible spectrum, and second, its absorptive power for the more refrangible rays at the violet end of

the spectrum is the subject of an English patent, specification No. 328,111, relating to the introduction into creams or other preparations for the protection of the skin, of phosphorescent cadmium sulphate, in view of absorptive power for the rays injurious to the epidermis. A quantity of 12 per cent. of cadmium sulphide relative to the total amount of the substances mentioned above gives a citron-yellow phosphorescence; 20 per cent. cadmium sulphide gives an orange phosphorescence; and 30 per cent. cadmium sulphide gives a red phosphorescence. Owing to its isomorphism with certain sulphides, particularly phosphorescent zinc sulphide, the phosphorescent cadmium sulphide can be mixed with the latter. This mixture can be introduced into non-greasy or greasy creams with a basis of glycerin or other fatty bodies, soaps, and toilet powders.

Owing to the specific properties of cadmium sulphide these different preparations allow pigmentation of the skin, but prevent erythemia. The luminescent creams having a common sulphide base show lasting phosphorescence; various shades of phosphorescence while maintaining a high luminescence; sensitivity to all the light rays of the visible spectrum absorbing part or all of the luminous rays from the green to the ultra-violet according to the quantity employed. Owing to the high luminescence of the cadmium sulphide it is necessary to limit the percentage of the phosphorescent mixture. If the mixture has too high a percentage it gives too great a luminiscence on the skin. If the proportion is too low the skin is not protected against the action of light. The proportions found to be most efficacious and which are preferred in the specification are from 2 to 5 per cent. of the phosphorescent cadmium sulphide mixture. Using sulphides having red or orange phosphorescence the amount can be increased up to 10 per cent., as these sulphides are less luminescent than the others.

Red Phosphorescence.—Neutral 30° glycerin, 66 gm.; purified stearic acid, 16 gm.; solution of ammonia, B.P., 6 gm.; distilled water, 8 gm.; 30 per cent. phosphorescent cadmium sulphide, 4 gm.

Orange Phosphorescence.—20 per cent. phosphorescent cadmium sulphide, 4 gm.

Citron-Yellow Phosphorescence.—12 per cent. phosphorescent cadmium sulphide, 4 gm.

Fluorescent Colors

The present specification includes the incorporation in the phosphorescent cadmium sulphide cream of fluorescent coloring substances. These coloring materials allow of producing a wide range of shades without decreasing the luminescence of the preparation to any appreciable extent. Dilute solution or rhodamine, eosine, esculine, methyl blue or violet and gentian violet are used for this purpose. The intensity and character of the rays reaching the skin can thus be regulated as desired, according to the conditions.

Radio-Active Additions

Radio-active substance in extremely dilute solution, as radium bromide or similar salt, may be incorporated in the luminescent mixture or in the preparations based thereon. The advantage is thus obtained of having beauty preparations which are readily radio-active and which can be used according to the circumstances. The preparation produced by means of this latter feature of the present invention will therefore allow selected light rays to reach the skin, the action of which will be further assisted by the radio-active compound.—(*Chem. & Druggist, Jan., 1931, page 9.*)

ABRODIL: A NEW MEDIUM FOR PYELOGRAPHY—During the past two years a number of complex iodine preparations have been evolved for the purpose of intravenous pyelography. One of these, uroselecton, a sodium salt of 2-oxy-5-iodophyridine-N-acetic acid containing 42 per cent. of iodine, was described in these pages a few months ago (*Prescriber,* 1930, Oct., 347-350). A still more recent compound, *Abrodil,* has just been placed on the market, and in its claims for clearness in contrast and absence of by-effects this product appears to offer considerable promise.

Abrodil is a sodium salt of mono-iodomethane-sulphonic acid, and is a white crystalline odorless powder. Its chemical formula is $I.CH_2.SO_3Na$, and its iodine content is 52 per cent. It is 70 per cent. soluble in water at room temperature; the solution is neutral and may be kept for prolonged periods without any change occurring

in the molecule. Aqueous solutions may be sterilized by boiling without risk of decomposition. A 4 per cent. solution of abrodil is isotonic with the blood.

Experiments on animals have proved that abrodil is well tolerated in large doses, and that it is excreted unchanged in the urine. Clinical trials by Bronner and Schüller (Cologne) and by Köhler (Berlin) have further proved its efficiency in pyelography in human beings.

Abrodil is usually administered intravenously in a 20 per cent. solution, 20 gm. of the substance being dissolved, sterilized, and subsequently filtered, in 100 c.c. distilled water. The 20 per cent. solution is administered at body temperature, the total quantity being injected in two to three minutes; the injection need not be made more slowly. The percentage strength of abrodil solutions, according to the latest reports, may also be very materially increased, as far as 40 per cent. having been employed that is using 50 c.c. only of distilled water as a solvent.—(*The Prescriber, Jan., 1931, page 37.*)

Red Squill Powder Now Popular As Safest Poison for Rats—An onion-like plant that grows wild along the Mediterranean coast produces the safest rat poison yet known. It is called red squill, and it produces large bulbs that are made into the red-squill powder that has proved so effective in killing rats. So says a leaflet on "Red-Squill Powders in Rat Control" just issued by the United States Department of Agriculture.

Red squill had been known in Europe for many years, says the leaflet, but apparently its use had not become popular, owing to extreme variation in the toxicity of the products available. Studies by the Bureau of Biological Survey, U. S. Department of Agriculture, however, showed that drying red-squill bulbs under controlled temperature conditions, makes it possible to produce a powder that is uniformly poisonous. The powder, although effective in destroying rats, does not seriously endanger other animal life. Reports of the progress of the investigation and the excellent results obtained in the early stages stimulated interest and powdered red squill is now manufactured in quantity in the United States. So far as known, the first

of these commercial red-squill powders was placed on the American market in 1926, and in five years these products have taken a leading place among rat poisons.

More than a year ago the department published a Technical Bulletin, Red Squill Powders as Raticides, giving in detail the results of the investigations. The new leaflet summarizes in popular form the technical bulletin and gives directions for preparing and exposing red-squill baits for rat control. It also discusses the effect of red squill on animals other than rats, showing that this poison is relatively harmless to human beings and domestic animals. As a test, one of the authors of the leaflet swallowed 15 grains of a toxic red-squill powder with no apparent harm, and later took 40 grains, which caused nausea and vomiting within 15 minutes, but no other effect. "Red-squill powder when mixed with food in the concentration recommended for rat control is not likely," it is stated, "to cause serious harm to farm animals in good health. It is possible that the irritant may cause death under certain conditions; so far as possible, therefore, red-squill baits for rats should be kept out of reach of other animals.

Copies of Leaflet 65-L, just published, may be obtained free on request to the Office of Information, U. S. Department of Agriculture, Washington, D. C., and copies of the longer report, Technical Bulletin 134-T, may be purchased for 10 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

Toilet Water Dermatitis—Writing on this subject in the *Journal of the American Medical Association* for September 6th, Dr. J. E. Lane and Dr. M. J. Strauss record a number of cases of dermatitis caused by the use of toilet waters. In the United States alcohol is denatured with so-called innocuous substances. In Canada the denaturants are limited to diethylphthalate and quinine hydrochloride, both of which are known to cause dermatitis. A curious form of this eruption described by German, French and Italian

dermatologists is "berlock dermatitis," first recorded by Freund, of Trieste, in 1916, which, it has been found, is caused by the oil of bergamot in eau de cologne, especially if it is applied to the skin after rather long exposure to sunlight, or when there has been excessive perspiration. Oddly enough, oil of bergamot alone does not produce dermatitis, but only when applied in alcoholic solution.

METHANOL (WOOD ALCOHOL) AS ANTIFREEZE—The following conclusions and recommendations are based on studies and observations to date:

Observations made by the Bureau of Mines have indicated that there is no danger of poisoning from the reasonable use of methanol as an antifreeze for automobile radiators.

The evidence that methanol poisoning has been caused by absorption through the skin is rare and inconclusive.

Practically continuous exposure to low concentrations and short intermittent exposure to high concentrations of methanol cause no apparent harm; but, on the other hand, continued exposure to high concentrations will cause serious poisoning.

All methanol, whether made by wood distillation methods or synthetic methods, or whether it is crude, refined, or highly purified, is poisonous when taken internally. It will cause serious poisoning, blindness, and possibly death when as little as two ounces is taken into the stomach.

To avoid misuse it is recommended that, in the future, all antifreeze methanol be brightly colored to enable garage attendants and the public to identify it as methanol; and to warn against misuse, particularly for beverage purposes.

The largest producers of methanol antifreeze label their containers so as to call attention to the hazards of misuse of methanol and also issue information and instructions to garage attendants and the consuming public warning against its misuse. It is recommended that these precautionary measures be adopted by all producers.—(*Jour. Ind. & Eng. Chem. News Ed.* 8, 23, p. 5, Dec., 1930.)

DRUG ADDICTION SCIENTIFICALLY STUDIED—A fundamental scientific attack upon drug addiction has been launched and under way for the past two years, according to Dr. William Charles White, chairman of the National Research Council's Committee. Dr. White thus summarizes the progress so far and the promises of future accomplishment.

Instead of treating the unfortunates who have become addicts to morphine or other habit forming preparations, the groups of scientists working on this problem have begun with a thorough investigation of the chemical, biological and medical phases of the problem.

First, the committee is attempting to replace habit forming drugs with drugs without addiction properties. Morphine, for instance, is strongly addicting, while codeine, which causes few addicts, can replace many uses of morphine if used in larger doses. Marked progress had been made in recent years in the replacement of cocaine by safe drugs in practically all its uses except application for surface anesthesia. This gave the committee hope that substitutes for other habit forming drugs could be found and the national and international control of the manufacture, handling and sale of narcotics made easier.

With the co-operation of the American Medical Association, the committee plans to furnish physicians with information on the latest discoveries of how non-habit forming drugs can be substituted for those that are likely to cause addicts.

To discover narcotic substitutes two research laboratories were established, one at the University of Virginia for chemical analysis and synthesis of alkaloid substances, and the other at the University of Michigan for the biological testing of the narcotics and their substitutes.

The National Research Council Committee has also worked closely with the United States Public Health Service and the Treasury Department Narcotic Bureau. The funds for the work have been provided by the Bureau of Social Hygiene, Inc., of New York City, of which Lawrence B. Dunham is director. The first report of the work will appear in the forthcoming issue of *Science*.—(*Science Service*.)

CORNSTALK RUBBER—So much public interest has been aroused in the substance, maizolith, developed by C. E. Hartford, Jr., at the United States Bureau of Standards, that the bureau has had to take up the work again in order to supply the demands for samples.

The story of maizolith concerns a senior student at the Iowa State College, and his laboratory thesis.

Young Mr. Hartford, who was working for a degree at Iowa State, discovered that if cornstalk pulp is put through certain mechanical operations and then combined with water, it will form a tough jelly. When this jelly dries it is tough and horny and much like hard rubber.

The Bureau of Standards asked Mr. Hartford to come on the government pay roll and work on his cornstalk rubber. Mr. Hartford came to Washington, completed his work, wrote a paper on it, and resigned. The bureau considered the matter closed and the work finished, but suddenly there developed such a continuous public demand for samples of maizolith, that a man had to be put back on the cornstalk rubber detail.

"The project is again active," stated the bureau.—(*Science Service.*)